EROSION PROCESSES APPENDIX

Soils

Soil Type and TPCC

Erod Apdx Table-1: The Area of BLM TPC Fragile Gradient on Each Soil Type in the North Fork Coquille Watershed
(Soils data from Haagen 1989; TPC data on file Coos Bay District-BLM)

Map Unit	SOILS	Slope	BLM land classified as: FGNW acres	FGNW percent of acres	FGR2 acres	FGR2 percent of acres	FGR1 acres	FGR1 percent of acres	% of FGNW + FGR2 acs.	% of FGNW+ FGR2+ FGR1 acs.
4D	Blachly Silty Clay Loam	30	5	0%	12	0%	84	1%	0%	1%
4E	Blachly Silty Clay Loam	30-50	0	0%	0	0%	119	2%	0%	1%
9	Chetco Silty Clay Loam		0	0%	0	0%	0	0%	0%	0%
10A	Chismore Silt Loam	0-3	0	0%	0	0%	0	0%	0%	0%
10B	Chismore Silt Loam	3-7	0	0%	0	0%	0	0%	0%	0%
10C	Chismore Silt Loam	7-12	0	0%	0	0%	0	0%	0%	0%
13C	Dement Silt Loam	2-12	0	0%	0	0%	0	0%	0%	0%
13D	Dement Silt Loam	12-30	0	0%	0	0%	1	0%	0%	0%
13E	Dement Silt Loam	30-50	0	0%	10	0%	116	2%	0%	1%
13F	Dement Silt Loam	50-70	0	0%	0	0%	0	0%	0%	0%
14F	Digger-Preacher-Umpcoos Assoc.	50-80	0	0%	31	1%	318	5%	0%	2%
15F	Digger-Umpcoos-Rock Outcrop Assoc.	50-90	49	1%	100	2%	141	2%	2%	2%
17B	Eilertsen Silt Loam	0-7	2	0%	0	0%	4	0%	0%	0%
18E	Etelka Silt Loam	30-50	0	0%	0	0%	0	0%	0%	0%
19F	Etelka-Remote Complex	50-70	0	0%	0	0%	0	0%	0%	0%
20E	Etelka-Rinearson-Orford Complex	30-50	5	0%	0	0%	4	0%	0%	0%
21D	Etelka-Whobrey Silt Loams	7-30	0	0%	0	0%	0	0%	0%	0%
22E	Etelka-Whobrey-Remote Complex	30-60	0	0%	0	0%	0	0%	0%	0%
24	Gardiner Sandy Loam		0	0%	0	0%	4	0%	0%	0%
27E	Harrington Very Gravelly Loam	30-50	0	0%	0	0%	0	0%	0%	0%
27F	Harrington Very Gravelly Loam	50-70	6	0%	0	0%	136	2%	0%	1%
30D	Honeygrove Silty Clay Loam	3-30	0	0%	0	0%	6	0%	0%	0%
30E	Honeygrove Silty Clay Loam	30-50	0	0%	0	0%	9	0%	0%	0%
33	Kirkendall Silt Loam		0	0%	0	0%	2	0%	0%	0%
34	Langlois Silty Clay Loam		0	0%	0	0%	0	0%	0%	0%
36C	McCurdy Silt Loam	3-15	0	0%	0	0%	0	0%	0%	0%
36D	McCurdy Silt Loam	15-30	0	0%	0	0%	0	0%	0%	0%
37C	Meda Loam	3-15	0	0%	0	0%	0	0%	0%	0%
38F	Milbury-Bohannon-Umpcoos Assoc.	50-80	1,879	45%	2,742	60%	2,471	35%	53%	45%
39F	Millicoma-Templeton Complex	50-75	0	0%	0	0%	0	0%	0%	0%
44D	Preacher-Blachly Assoc.	12-30	4	0%	2	0%	6	0%	0%	0%
44E	Preacher-Blachly Assoc.	30-60	92	2%	42	1%	230	3%	2%	2%
45D	Preacher-Blachly-Digger Assoc.	12-30	0	0%	0	0%	0	0%	0%	0%
45E	Preacher-Blachly-Digger Assoc.	30-60	0	0%	26	1%	17	0%	0%	0%

Erod Apdx Table-1: The Area of BLM TPC Fragile Gradient on Each Soil Type in the North Fork Coquille Watershed
(Soils data from Haagen 1989; TPC data on file Coos Bay District-BLM)

Map Unit	SOILS	Slope	BLM land classified as: FGNW acres	FGNW percent of acres	FGR2 acres	FGR2 percent of acres	FGR1 acres	FGR1 percent of acres	% of FGNW + FGR2 acs.	% of FGNW+ FGR2+ FGR1 acs.
46D	Preacher-Bohannon Loams	3-30	16	0%	65	1%	129	2%	1%	1%
46E	Preacher-Bohannon Loams	30-60	201	5%	312	7%	1,057	15%	6%	10%
46F	Preacher-Bohannon Loams	60-90	362	9%	619	14%	1,845	27%	11%	18%
47B	Pyburn Silty Clay	0-8	0	0%	0	0%	0	0%	0%	0%
48	Quosatana Silt Loam		0	0%	0	0%	0	0%	0%	0%
49E	Remote Loam	30-50	0	0%	0	0%	0	0%	0%	0%
49F	Remote Loam	50-75	0	0%	0	0%	0	0%	0%	0%
50E	Remote-Digger-Preacher Complex	30-50	3	0%	66	1%	1	0%	1%	0%
51	Rinearson Silt Loam	30-50	0	0%	0	0%	0	0%	0%	0%
52D	Salander Silt Loam	2-30	0	0%	0	0%	0	0%	0%	0%
52E	Salander Silt Loam	30-50	0	0%	0	0%	5	0%	0%	0%
52F	Salander Silt Loam	50-75	0	0%	0	0%	4	0%	0%	0%
57	Udorthents		0	0%	0	0%	0	0%	0%	0%
58F	Umpcoos-Rock Outcrop	70-99	1,533	37%	505	11%	254	4%	23%	15%
62	Willanch Fine Sandy Loam		0	0%	0	0%	0	0%	0%	0%
63B	Wintley Silt Loam	0-8	0	0%	0	0%	0	0%	0%	0%
63C	Wintley Silt Loam	8-15	0	0%	0	0%	0	0%	0%	0%
63D	Wintley Silt Loam	15-30	0	0%	0	0%	0	0%	0%	0%
65	Zyzzug Silt Loam		0	0%	0	0%	0	0%	0%	0%
Totals			4,159	100%	4,532	100%	6,960	100%	100%	100%

Erod Apdx Table-2: The Area of Each Soil Type Classified as TPC Fragile Gradient on BLM in the North Fork Coquille Watershed (Soils data from Haagen 1989; TPC data on file Coos Bay District-BLM)

Map Unit	SOILS	Slope	total acres of each soil type on BLM	area of each soil type, on BLM, classified as:						% of soil type classed as FGNW or FGR2	% of soil type classed as FGNW or FGR2 or FGR1
				FGNW		FGR2		FGR1			
				acres	percent	acres	percent	acres	percent		
4D	Blachly Silty Clay Loam	30	1,240	5	0%	12	1%	84	7%	1%	8%
4E	Blachly Silty Clay Loam	30-50	800	0	0%	0	0%	119	15%	0%	15%
9	Chetco Silty Clay Loam		0	0		0		0		0%	0%
10A	Chismore Silt Loam	0-3	84	0	0%	0	0%	0	0%	0%	0%
10B	Chismore Silt Loam	3-7	66	0	0%	0	0%	0	0%	0%	0%
10C	Chismore Silt Loam	7-12	8	0	0%	0	0%	0	0%	0%	0%
13C	Dement Silt Loam	2-12	0	0	0%	0	0%	0	0%	0%	0%
13D	Dement Silt Loam	12-30	24	0	0%	0	0%	1	5%	0%	5%
13E	Dement Silt Loam	30-50	518	0	0%	10	2%	116	22%	2%	24%
13F	Dement Silt Loam	50-70	0	0		0		0		0%	0%
14F	Digger-Preacher-Umpcoos Assoc.	50-80	709	0	0%	31	4%	318	45%	4%	49%
15F	Digger-Umpcoos-Rock Outcrop Assoc.	50-90	461	49	11%	100	22%	141	30%	32%	63%
17B	Eilertsen Silt Loam	0-7	172	2	1%	0	0%	4	2%	1%	3%
18E	Etelka Silt Loam	30-50	30	0	0%	0	0%	0	0%	0%	0%
19F	Etelka-Remote Complex	50-70	0	0		0		0		0%	0%
20E	Etelka-Rinearson-Orford Complex	30-50	36	5	14%	0	0%	4	11%	14%	25%
21D	Etelka-Whobrey Silt Loams	7-30	32	0	0%	0	0%	0	0%	0%	0%
22E	Etelka-Whobrey-Remote Complex	30-60	11	0	0%	0	0%	0	0%	0%	0%
24	Gardiner Sandy Loam		82	0	0%	0	0%	4	5%	0%	5%
27E	Harrington Very Gravelly Loam	30-50	0	0		0		0		0%	0%
27F	Harrington Very Gravelly Loam	50-70	327	6	2%	0	0%	136	42%	2%	43%
30D	Honeygrove Silty Clay Loam	3-30	2,033	0	0%	0	0%	6	0%	0%	0%
30E	Honeygrove Silty Clay Loam	30-50	3,314	0	0%	0	0%	9	0%	0%	0%
33	Kirkendall Silt Loam		96	0	0%	0	0%	2	2%	0%	2%
34	Langlois Silty Clay Loam		0	0		0		0		0%	0%
36C	McCurdy Silt Loam	3-15	1	0	0%	0	0%	0	0%	0%	0%
36D	McCurdy Silt Loam	15-30	0	0		0		0		0%	0%
37C	Meda Loam	3-15	44	0	0%	0	0%	0	0%	0%	0%
38F	Milbury-Bohannon-Umpcoos Assoc.	50-80	9,225	1,879	20%	2,742	30%	2,471	27%	50%	77%
39F	Millicoma-Templeton Complex	50-75	0	0		0		0		0%	0%
44D	Preacher-Blachly Assoc.	12-30	246	4	2%	2	1%	6	2%	2%	5%
44E	Preacher-Blachly Assoc.	30-60	1,476	92	6%	42	3%	230	16%	9%	25%
45D	Preacher-Blachly-Digger Assoc.	12-30	27	0	0%	0	0%	0	0%	0%	0%
45E	Preacher-Blachly-Digger Assoc.	30-60	172	0	0%	26	15%	17	10%	15%	25%
46D	Preacher-Bohannon Loams	3-30	1,638	16	1%	65	4%	129	8%	5%	13%
46E	Preacher-Bohannon Loams	30-60	5,672	201	4%	312	5%	1,057	19%	9%	28%
46F	Preacher-Bohannon Loams	60-90	5,416	362	7%	619	11%	1,845	34%	18%	52%
47B	Pyburn Silty Clay	0-8	105	0	0%	0	0%	0	0%	0%	0%

Erod Apdx Table-2: The Area of Each Soil Type Classified as TPC Fragile Gradient on BLM in the North Fork Coquille Watershed (Soils data from Haagen 1989; TPC data on file Coos Bay District-BLM)											
Map Unit	SOILS	Slope	total acres of each soil type on BLM	area of each soil type, on BLM, classified as:						% of soil type classed as FGNW or FGR2	% of soil type classed as FGNW or FGR2 or FGR1
				FGNW		FGR2		FGR1			
				acres	percent	acres	percent	acres	percent		
48	Quosatana Silt Loam		89	0	0%	0	0%	0	0%	0%	0%
49E	Remote Loam	30-50	0	0		0		0		0%	0%
49F	Remote Loam	50-75	0	0		0		0		0%	0%
50E	Remote-Digger-Preacher Complex	30-50	128	3	2%	66	52%	1	1%	54%	55%
51	Rinearson Silt Loam	30-50	23	0	0%	0	0%	0	0%	0%	0%
52D	Salander Silt Loam	2-30	0	0		0		0		0%	0%
52E	Salander Silt Loam	30-50	18	0	2%	0	0%	5	27%	2%	28%
52F	Salander Silt Loam	50-75	15	0	0%	0	0%	4	24%	0%	24%
57	Udorthents		10	0	0%	0	0%	0	0%	0%	0%
58F	Umpcoos-Rock Outcrop	70-99	2,471	1,533	62%	505	20%	254	10%	82%	93%
62	Willanch Fine Sandy Loam		0	0		0		0		0%	0%
63B	Wintley Silt Loam	0-8	11	0	0%	0	0%	0	0%	0%	0%
63C	Wintley Silt Loam	8-15	23	0	0%	0	0%	0	0%	0%	0%
63D	Wintley Silt Loam	15-30	6	0	0%	0	0%	0	0%	0%	0%
65	Zyzzug Silt Loam		0	0		0		0		0%	0%
Totals			36,861	4,159	N/A	4,532	N/A	6,960	N/A	N/A	N/A

Of the BLM acres classified as FGNW in the North Fork Coquille, 91% are on three soil types: Mulbury-Bohannon-Umpcoos Association (45%), Umpcoos-Rock Outcrop (37%) and Preacher-Bohannon loams on 60 to 90% slopes (8.7%). The individual soil types in the Mulbury-Bohannon-Umpcoos Association are so intricately intermingled that it is not practical to map them as separate units at the scale used for the soil survey maps. The soils in this association are on 50 to 80% slopes and range from the shallow skeletal Umpcoos to the moderately deep Mulbury and Bohannon soils, and include some rock outcrops. This range of variation is reflected in the TPC classifications of these sites with 20% of the acres of this soil association classed FGNW, 30% classed FGR2, 27% classed FGR1 with the remainder not classified fragile gradient in TPC.

The Umpcoos-Rock Outcrop soils are on the whole the most fragile soil type in this Watershed with respect to shallow rapid translational types of slides with 62% of these sites classed as FGNW and nearly all the rest of these soils on BLM classed as FGR1 or FGR2.

The soil type with the third most BLM acres classified as FGNW is Preacher-Bohannon loam soils on 60 to 90% slopes, which are deep and moderately deep soils. Inclusions of Mulbury and Digger soils make up about 15% of this mapping unit. Almost 7% of the BLM lands supporting this soil type are classed FGNW, and 11.4% are classed FGR2, with these sites occupying the steeper extreme of the slope range for this map unit. Generally, the soils on the moderate end of the slope range for this soil type are not classified in the TPC as fragile gradient, and these occupy 47.8% of the soil type's area.

Erod Apdx Table-3 is a summary table showing the soils on BLM land where 25% or more of the area with the soil type are classified as fragile gradient in the TPC, and the area of the soil type on BLM land is greater than 100 acres. The locations of these soils, and the TPCC fragile gradient classes on BLM land are shown on Erod Appendix Map-1. The soil types shown on Erod Apdx Table 3, with slopes ranging from 50 to 60% slopes that are on BLM sites classified as fragile gradient are primarily there for two reasons. Many of these soils have inclusions of rock outcrops and other soils with steeper gradients that were not practical to delineate at the scale used to map the soils. For example, Remote-Digger-Preacher Complex soils typically contain inclusion of Umpcoos soils. The second reason is the TPCC and the soils were mapped independently from each other and no attempt was made to edgematched these two data sets when they were digitized. Consequently, while many soil type and TPC polygons represent similar soil and slope characteristics, their boundaries are not the same. However, the boundaries are close enough for planning and watershed scale analyses purposes. These differences are normally resolved at the site scale as a normal part of ID team process, when needed for project development.

Erod Apdx Table-3: Soils Where 25% or More of the Area with the Soil Type, on BLM Land, Are Classified as Fragile Gradient in the TPC and the Area of the Soil Type on BLM Land Is Greater than 100 Acres (Soils data from Haagen 1989; TPC data on file Coos Bay District-BLM)

Map Unit	SOILS	Slope	General location in the Watershed	total acres of each soil type on BLM-all TPC classes	percent of BLM acres in the Watershed	area of each soil type, on BLM, classified as: FGNW acres	FGR2 acres	FGR1 acres	not fragile gradient
38F	Milbury-Bohannon-Umpcoos Assoc.	50-80	on Tyee formation	9,219	25%	1,879	2,737	2,469	2,134
58F	Umpcoos-Rock Outcrop	70-99		2,471	7%	1,533	505	254	179
50E	Remote-Digger-Preacher Complex	30-50		128	0%	3	66	1	58
46E	Preacher-Bohannon Loams	30-60	both inside and outside of Tyee formation	5,672	15%	201	312	1,057	4,102
46F	Preacher-Bohannon Loams	60-90		5,416	15%	362	619	1,845	2,590
15F	Digger-Umpcoos-Rock Outcrop Assoc.	50-90	outside Tyee formation	461	1%	49	100	141	171
14F	Digger-Preacher-Umpcoos Assoc.	50-80		709	2%	0	31	318	360
45E	Preacher-Blachly-Digger Assoc.	30-60		172	0%	0	26	17	129
27F	Harrington Very Gravelly Loam	50-70	Roseburg volcanic	327	1%	6	0	136	185
	Subtotal			24,574	67%	4,034	4,396	6,236	9,908
	All other soil types in the Watershed			12,287	33%	125	136	724	11,302
	Totals			36,861	100%	4,159	4,532	6,960	21,210
	Percent of BLM land in each TPC fragile gradient class					11%	12%	19%	58%

Distribution of Soil types in the Watershed

The soils in the upper approximately 70% of the watershed is composed of soils formed in residuum and colluvium from the Tyee geologic formation. The Tyee formation consist of sedimentary rocks that are rhythmically bedded micaceous sandstones, siltstones, and mudstones of Eocene age. In some locations, the sandstone member is thick, massive and hard enough to create cliffs, escarpments, sharp rocky ridges, and outcropping “bands” of sandstone. In this climate, these geologic formations have topography and landforms of predominantly steep slopes that are highly dissected. There are also some large flats, broad gently sloping ridgetops, and moderate slopes. Some of the most common soils in this part of the Watershed are the Milbury, Bohannon, Umpcoos, Rockland, Preacher, and Blachly series. These soils are mapped in various combinations and on various slopes. Milbury soils are moderately deep (20" to 40"), loamy-skeletal soils (greater than 35% gravel and cobbles). Bohannon soils are also moderately deep but are fine-loamy throughout and have less than 35% gravel and cobbles. Umpcoos soils are the most fragile, and along with Rockland, occur on the steepest slopes in the basin. They are shallow (10" to 20") gravelly loams that occur abruptly over hard sandstone. Rockland is a miscellaneous land type that also includes soils less than 10 inches deep over hard sandstone. The Preacher series is a deep (greater than 40") fine-loamy soil that usually occurs on more moderate slopes. Blachly soils are deep red clayey soils that occur on the gentle to moderate slopes, large flats, benches, and broad ridge-tops.

The lower 30% of the watershed is in Camas Valley, White Tail Ridge and Roseburg geologic formations with a very small representation of the Otter Point Formation in the very southern portion. The Camas Valley, White Tail Ridge and Roseburg formations are composed largely of sedimentary rocks of Eocene age with the Roseburg Formation containing some intrusions of igneous rock, mainly basalt. The Otter Point Formation is composed of techtonically sheared assemblages of sedimentary, volcanic, and metamorphic rocks. The basalts can be hard, erosion resistant rocks that cause locally steep slopes or cliffs. The topography in the lower 30% of the Watershed is more moderate and the landforms have gentle to moderate slopes that are not as heavily dissected. Soils on the uplands of the lower basin consist of the deep, red, clayey Honeygrove and Blachly series on gentle to moderate slopes. Deep and moderately deep, brown, fine-loamy Preacher and Bohannon soils occur on gentle to steep slopes. The moderately deep, loamy skeletal Digger, and shallow, loamy skeletal, Umpcoos, along with some rock outcrop, occur on the steepest slopes. The Otter Point Formation is typically overlain by Etelka and Whobrey, which are moderately well-drained and somewhat poorly drained clayey soils. Whobrey soils have a very dark gray clay substratum that limits rooting depth.

Most flood plains and Quaternary terrace soils in the North Fork Coquille Watershed occur along the major streams in the lower portion of the watershed. The flood plain soils consist mainly of the deep, well drained, sandy Gardiner series and the similar but fine silty Kirkendall series. Terrace soils occur above the flood plains and consist mainly of the similar deep, well drained, clayey Wintley and Pyburn soils; deep, fine-silty, well drained Eilertson soils, and deep, clayey, moderately well drained Chismore soils (Haagen 1989).

Soil Properties with Respect to Management

The soils within the North Fork Coquille Watershed Analysis area have been rated on compaction hazard and susceptibility to erosion when no cover is present. Surface erosion by weathering agents such as wind and water results from sediment availability and transport capacity. Soil erodibility is strongly related to soil texture. Coarse and fine soil particles generally have lower erodibilities than intermediate textures. Coarse or large particles are more difficult for water to move while fine soils such as clays possess enough cohesiveness to hamper movement. Intermediate classes generally have high silt contents which lack cohesion in wet conditions. Compaction hazard is based upon the physical properties of soils such as moisture content and composition. Soils are rated as slight, moderate, or severe when denoting susceptibility to compaction. Slight means soils generally can withstand use under most conditions. Moderate means soil properties are unfavorable for use under some conditions and should be restricted. Severe means soils are unfavorable enough that use in most instances could result in soil conditions which are very difficult to remediate. Through Best Management Practices, these problems can often be remediated. Erosion susceptibility and compaction hazard for the soils of the North Fork Coquille Watershed are listed in Erod Apdx Table-4.

Erod Apdx Table-4: Erosional Susceptibility & Compaction Hazard (Townsend *et al.* 1977; Haagen 1989)

Soil	Permeability	Erosional Susceptibility	Compaction Hazard	Slope Stability
Blachly Silty Clay Loam (4)	slow	slight on slopes <10% and moderate on slopes >10%	severe	
Chetco Silty Clay Loam (9)	very slow	slight on slopes <10% and moderate on slopes >10%	severe	
Chismore Silt Loam (10)	slow	slight	severe	
Dement Silt Loam (13)	moderately slow	moderate on slopes 10 - 35%, severe on slopes >35%	severe	Slopes >10% susceptible to slumping
Digger-Preacher-Umpcoos Assoc. (14)	moderate to moderately rapid	severe in Digger and Umpcoos soils and slight in slopes <10% moderate in slopes 10-35% and severe on slopes >35% on Preacher soils	slight to moderate	severe- very unstable side slopes on Digger and Umpcoos soils
Digger-Umpcoos-Rock Outcrop Assoc. (15)	moderately rapid to variable in Rock outcrops	severe	slight	severe- very unstable side slopes
Eilertsen Silt Loam (17)	moderate	slight	severe	
Etelka Silt Loam (18)	slow	moderate on slopes 10 - 35%, severe on slopes 35 - 60%	moderate to severe	Landslide hazards are moderate on slopes 10 - 35%, severe on slopes 35 - 60%
Etelka-Remote Complex (19)	slow to moderate	moderate on slopes 10 - 35%, severe on slopes 35 - 60%	moderate to severe	Landslide hazards are moderate on slopes 10 - 35%, severe on slopes 35 - 60%
Etelka-Rinearson-Orford Complex (20)	slow to moderate	moderate on slopes 10 - 35%	moderate	Landslide hazards are moderate on slopes 10 - 35%

Soil	Permeability	Erosional Susceptibility	Compaction Hazard	Slope Stability
Etelka-Whobrey Silt Loams (21)	slow	moderate on slopes 10 - 35%, severe on slopes 35 - 60%	moderate to severe	Landslide hazards are moderate on slopes 10 - 35%, severe on slopes 35 - 60% on Etelka soils. Landslide hazard is severe with failures on slopes >20% common on Whobrey soils
Etelka-Whobrey-Remote Complex (22)	slow	moderate on slopes 10 - 35%, severe on slopes 35 - 60%	moderate to severe	Landslide hazards are moderate on slopes 10 - 35%, severe on slopes 35 - 60% on Etelka soils. Landslide hazard is severe with failures on slopes >20% common on Whobrey soils
Gardiner Sandy Loam (24)	rapid	slight	slight	
Harrington Very Gravelly Loam (27)	moderately rapid	severe	slight	Landslide hazard is moderate
Honeygrove Silty Clay Loam (30)	moderately slow	slight on slopes <10% and moderate on slopes >10%	severe	Slopes >10% susceptible to slumping
Kirkendall Silt Loam (33)	slow	slight	severe	
Langlois Silty Clay Loam (34)	slow	slight	severe	
McCurdy Silt Loam (36)	moderately slow	moderate	severe	
Meda Loam (37)	moderate to rapid	moderate	moderate	
Milbury-Bohannon-Umpcoos Assoc. (38)	moderate to moderately rapid	severe in Milbury and Umpcoos soils and slight in slopes <10% moderate in slopes 10-35% and severe on slopes >35% on Bohannon soils	slight to moderate	severe- very unstable side slopes on Umpcoos soils and severe landslide hazard with roads in headwalls being unstable in Milbury soils
Millicoma-Templeton Complex (39)	moderate to moderately rapid	severe	moderate	
Preacher-Blachly Assoc. (44)	moderate to moderately slow	slight on slopes <10% and moderate on slopes >10%, severe on slopes >35% on Preacher soils	moderate to severe	
Preacher-Blachly-Digger Assoc. (45)	moderately slow to moderately rapid	severe in Digger soils, slight on slopes <10% and moderate on slopes >10%, severe on slopes >35% on Preacher soils	slight to severe	severe- very unstable side slopes on Digger soils
Preacher-Bohannon Loams (46)	moderate	slight, slopes <10% mod, slopes 10-35%, severe on slopes >35%	moderate	
Pyburn Silty Clay (47)	very slow	slight	severe	
Quosatana Silt Loam (48)	slow	slight	severe	
Remote Loam (49)	moderate	severe	severe	moderate
Remote-Digger-Preacher Complex (50)	moderate to moderately rapid	severe in Digger and Remote soils and slight in slopes <10% moderate in slopes 10-35% and severe on slopes >35% on Preacher soils	slight to severe in Remote soils	severe - very unstable side slopes on Digger soils
Rinearson Silt Loam (51)	moderate	moderate	moderate	
Salander Silt Loam (52)	moderate	severe	moderate	
Udorthents (57)	varies	varies	varies	
Umpcoos-Rock Outcrop (58)	moderately rapid to variable in Rock outcrops	severe	slight	severe- very unstable side slopes

Soil	Permeability	Erosional Susceptibility	Compaction Hazard	Slope Stability
Willanch Fine Sandy Loam (62)	moderately rapid	slight	slight	
Wintley Silt Loam (63)	moderately slow	moderate	moderate	
Zyzzug Silt Loam (65)	moderately slow	slight	moderate	

References

Haagen, J.T. 1989. *Soil Survey of Coos County, Oregon*. USDA. SCS 269 pgs + attached maps.

Townsend, M.A.; Pomerening, J.A.; Thomas, B.R. 1977. *Soil Inventory of the Coos Bay District*. USDI BLM Coos Bay Dist, Coos Bay, OR 259 pgs + attached maps.

Middle Creek Historical Landslide Inventory

2001 Introduction

This landslide inventory was done in 1994 by Craig Garland (soil scientist now retired) for the first the Middle Creek Watershed Analysis. The Middle Creek document is replaced by the North Fork Coquille Watershed Analysis. However, the findings of the Middle Creek landslide inventory have value for understanding landslide processes in the North Fork Coquille Watershed in general and in the Middle Creek Subwatershed in particular. Therefore, this document is included in the Erosion Appendix of the North Fork Coquille Watershed Analysis as a reference. This landslide inventory document is edited to reflect current hydrologic unit naming conventions, and to make it easier to read. The geology formations names used in this inventory are those in common use in 1994 and based on the geologic maps of Coos County by Baldwin (1973a&b).

Inventory Process

A historical landslide inventory using 9 flights of aerial photographs was conducted of the Middle Creek Subwatershed. The photo sets used were: 1950, 1955, 1959, 1963/64/65, 1970, 1976, 1981, 1966, and 1992. Because of the large size of the this Subwatershed (about 52 square miles or 33,280 acres) only about 12.5 square miles or 8,000 acres, which is 24% of the Subwatershed, was inventoried. Four tiers of sections, with three sections in each tier, were inventoried. These were fairly equally spaced across the Subwatershed in an attempt to represent all geologic formations, topography, and soils. The three photos in each of the four sample tiers were oriented north-south.

Two tiers of photos were in the lower 1/3 of the Subwatershed, in primarily the Roseburg and Looking-glass geologic formations, and two tiers were in the upper 2/3s of the Subwatershed which is comprised of the Flournoy/Tyee geologic formations.

The purposes of the inventory were to: (1) determine the extent of landsliding in the Subwatershed (2) determine the amount that is natural and that which is man-related (3) compare the two, and (4) estimate the importance of landsliding on erosion processes and (5) estimate the effect of landsliding on streams.

In the 6.5 sections inventoried in the middle and upper part of the Subwatershed, there was considerable landsliding of the shallow rapid type. This was subdivided into: (1) debris avalanches--shallow rapid landslides that are not fluid charged, and do not flow like water, and (2) debris torrents-- shallow, extremely rapid landslides that are so highly charged with water that they flow down drainages like water and can scour to bedrock, everything in their paths. Debris avalanches typically occur on steep (60 to 80%) to very steep (80%+) slopes, and in shallow (<20 inches) to moderately deep (20- 40 inches) loamy to gravelly soils over hard bedrock. Debris torrents occur under similar conditions but in draws where channel gradient is often less, and where water can be concentrated. Both are dependent on frequency, intensity, and duration of precipitation. Disturbance of vegetation, in conjunction with rainfall, can also be a significant factor in triggering landslides. See tables below.

Compilation of Landslide Data:

Photo set	Debris Avalanches (DA)					Debris Torrents (DT)				
	Road	CC	Rd+CC	all management related	Natural origin	Road	CC	Rd+CC	all management related	Natural origin
1950	1	0	0	1	15	0	1	0	1	15
1955	3	7	0	10	7	5	9	1	15	19
1959	10	4	0	14	6	1	2	1	4	18
1964*	18	15	7	40	1	7	18	5	30	6
1970	17	0	3	20	0	6	4	10	20	2
1976	5	2	5	12	0	0	2	0	2	0
1981	0	4	4	8	0	0	7	4	11	2
1986	5	6	4	15	0	1	4	0	5	0
1992	0	0	0	0	0	0	0	0	0	0
total	59	38	23	120	29	20	47	21	88	62
				Total Debris Avalanches:	143				Total Debris Torrents:	150
									Total Shallow Rapid Landslide Events: 309	

* a mix of 1963, 1964 and 1965 aerial photos were used to get complete coverage

Landslides by Photo Set:

Photo set	Total Debris Avalanche-management related	Total Debris Torrent-management related	Total Debris Avalanche-natural occurring	Total Debris Torrent-natural occurring	Total management related Debris Torrents + Debris Avalanches	Total natural occurring Debris Torrents + Debris Avalanches
1950	1	1	15	15	2	30
1955	10	15	7	19	25	26
1959	14	4	6	18	18	24
1964*	40	30	1	6	70	7
1970	20	10	0	2	30	2
1976	12	12	0	0	24	0
1981	8	11	0	2	19	2
1986	15	5	0	0	20	0
1992	0	0	0	0	0	0
total	120	88	29	62	208	91

* a mix of 1963, 1964 and 1965 aerial photos were used to get complete coverage

Number of Slide Events That Delivered Sediment to Streams:

Photo set	Sediment delivery by receiving stream order			Total sediment delivery events	Management related sediment delivering debris torrents	Natural origin sediment delivering debris torrents
	1st	2nd	3rd			
1950	11	14	7	32	1	31
1955	10	15	20	45	15	30
1959	7	20	11	38	4	34
1964*	4	8	33	45	30	15
1970	6	4	9	19	10	9
1976	2	7	9	18	12	6
1981	5	12	0	17	11	6
1986	3	5	2	10	5	5
1992	0	0	0	0	0	0
total	48	85	91	224	88	136

Total number of events minus total sediment delivering events equals the number of slide events that did not deliver sediment to streams = 299 - 224 = 75 debris avalanches that did not deliver sediment to streams.

Analysis and Discussion

1. Landsliding, as debris torrents and debris avalanches, is the major form of soil erosion in Flournoy/Tyee geologic formations in the Middle Creek Subwatershed. This is the upper (approximately) 2/3 of the Subwatershed.

2. In the lower 1/3 of the Subwatershed, there was only one landslide noted a deep seated earth flow along lower Middle Creek. This part of the Subwatershed has mostly gentle to moderate slopes characteristic of these geologic formations and soils, and little landsliding was expected. If the sample size had been increased some additional landsliding likely would have shown up.

3. The rate of landsliding in the Middle Creek Subwatershed has decreased as road construction practices have improved since the early 70s, and almost all of the roads are now in. In addition, most of the timber on private lands has been harvested in the last 30 years, and the remaining timber on Bureau managed lands either has been placed in a non-harvest category or is subject to very strict harvest guidelines. Also, the last ten years have been relatively dry and landslide activity has been minimal.

4. For the sections sampled, over the 42 year period, there were a total of 299 landslides identified, 208 of which were manrelated (70%) and 91 which were natural (30%) . Of the natural events, 62 were debris torrents, and 29 were debris avalanches. There were a total of 149 debris avalanches and 150 debris torrents.

5. The late 1940s and through the 1950s there must have been several wetter than normal winters and/or intense storms, as in the 6.5 sample sections in the middle to upper Subwatershed, there were 28 debris avalanches and 52 debris torrents that were natural in origin. Some of the debris torrents were major and scoured Middle Creek, Park Creek, and some major tributaries to bedrock literally for miles.

6. Small natural landslides are very difficult to identify and were probably under-counted.

7. In the late 1950s through the mid-1970s, man-related soil/slope failures dominated as road construction and clearcutting reached the middle and upper parts of the Subwatershed. As in the natural landslides, wet winters and/or intense storms were likely the triggering events. In this period, there were 106 man-related landslides, 64 of which were directly related to road construction. The rest were clearcut or clearcut plus road related. In places, road sidecast was so massive that the road continued to actively fail for 15 to 20 years, but in general, man-related (MR) events, although more numerous, were not as large as natural ones.

8. Debris torrents can have tremendous impacts, both negative and positive, on all orders of streams (at least Middle Creek and smaller). Debris torrents can sometimes scouring to bedrock for a distance of miles. They can also leave

large quantities of cobbles, gravels, sands, and silts as well as large woody debris scattered along streams. Debris avalanches provide materials that can act as initiation points for debris torrents. Debris avalanches can be a source of large woody debris, rock, gravels and sands that can be used by aquatic life.

9. One of the early objectives of the inventory was to determine how much sediment was being delivered to streams as a result of landsliding. After several attempts to quantify sediment delivery rates, from air photo examination, it was given up as either too difficult or too misleading. It is not considered possible to determine from landslide scars how much of the eroded material actually became sediment, how much remained entrained along the channel, and what portion of the deposits were actually beneficial.

10. Of the 299 landslide events inventoried, 224 were debris torrents and were thus in drainages by definition. An additional 45 debris avalanches reached drainages and so were considered "sediment producing." Other debris avalanches left bare scars on hillsides that undoubtedly also produced additional fine sediments to stream channels.

11. Although not specifically part of this inventory, many instances of logging and road construction practices were noted on the earlier photos that would have increased sedimentation rates: (1) powerline construction that completely removed all the vegetation from the right of way, (2) random tractor logging with skid roads occupying up to 50% or more of the area logged, (3) yarding logs down draws using either tractors or cable equipment, (4) yarding logs directly through live, major order streams, i.e. Middle Creek using either tractors or cables, and (5) building roads up streams that encroached on the stream channel. None of the photos used in the inventory went back as far as splash dam logging days.

12. With more time to spend on photo interpretation, i.e. to do whole subwatersheds, and data compilation, along with some field work to actually measure volumes (estimate?) a more accurate and detailed assessment could be prepared. References Baldwin, E.M. 1973a. Geologic Map of the Middle Section of Coos County, Oregon. Baldwin, E.M. 1973b. Geologic Map of the North Section of Coos County, Oregon.

References

Baldwin, E.M. 1973a. Geologic Map of the Middle Section of Coos County, Oregon.
Baldwin, E.M. 1973b. Geologic Map of the North Section of Coos County, Oregon.